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III. . .

$\begin{aligned} 1. \quad & OE = \sqrt{BE^2 + OB^2} = \sqrt{\left(\frac{1}{4}\sqrt{214657}\right)^2 + 40^2}, \\ B. \quad & = \sqrt{(13416\frac{1}{4} + 1600)} = \sqrt{15016\frac{1}{4}} = 122.5402 + \text{ft.} = \text{the length} \\ & \text{of the ladder.} \end{aligned}$	$= \frac{1}{4}\sqrt{214657} = 115.8278 + \text{ft.}$
<ol style="list-style-type: none"> <li>1. <math>111.8796 + \text{ft.} = \text{the distance from base of the ladder to the base of the tower } FC,</math></li> <li>2. <math>118.8111 + \text{ft.} = \text{the distance from the base of the ladder to the base of the tower } AD.</math></li> <li>3. <math>115.8278 + \text{ft.} = \text{the distance from the base of the ladder to the base of the tower } BE,</math> and</li> <li>4. <math>122.5402 + \text{ft.} = \text{the length of the ladder.}</math></li> </ol>	

[From *Finkel's Mathematical Solution Book*, p. 299.]

[NOTE.—This method of solution may be easily extended to the more general case, viz., when the triangle is scalene.]



## ALGEBRA.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

### SOLUTIONS OF PROBLEMS.

44. Proposed by LEONARD E. DICKSON, M. A., Fellow in Mathematics, University of Chicago.

Find the general term in the series 1, 3, 10, 35, 126, 462, 1716, 6435, 24310, . . ., which plays a remarkable part in some recent theorems in my Theory of Regular Polygons.

**Solution by the PROPOSER.**

This series is a "diagonal" in the Triangle of Pascal, as shown in the following table:—

C	0	1	2	3	4	5	6	7	8
0	1								
1		1							
2			1						
3				3	1				
4					4	6	4	1	
5						10	5	1	
6							15	20	15
7								35	21
8									7
9									1
									126

Since the  $m$ th term in the series lies at the intersection of column  $m$  with

row  $(2m-1)$ , it is  $\frac{(2m-1)(2m-2)\dots(2m-m)}{1\cdot 2\cdot 3\dots m}$

$$= \frac{(2m-1)(2m-2)\dots(m+1)}{1\cdot 2\cdot 3\dots(m-1)} = \frac{(2m)!}{2(m!)^2}.$$

The part played by the series in the Theory of Regular Polygons is indicated in an article in the current issue of the *Annals of Mathematics*.

Also solved by A. H. BELL, and Professor J. F. W. SCHEFFER.

45. Proposed by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio University, Athens, Ohio.

$$\text{Find } x \text{ from } \cos^{-1} \frac{1-x^2}{1+x^2} + \tan^{-1} \frac{2x}{1-x^2} = \frac{4\pi}{3}.$$

I. Solution by T. W. PALMER, A. M., Professor of Mathematics, University of Alabama; H. W. DRAUGHON, Olio, Mississippi; A. L. FOOTH, C. E., Middlebury, Connecticut; and the PROPOSER.

$$\begin{aligned} \text{Let } \tan \theta &= x. \text{ Then } \tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta} = \frac{2x}{1-x^2}; \text{ and } \frac{1-x^2}{1+x^2} \\ &= \frac{1-\tan^2 \theta}{1+\tan^2 \theta}, = \cos^2 \theta (1 - \tan^2 \theta), = (\cos^2 \theta - \sin^2 \theta), = \cos 2\theta. \end{aligned}$$

$$\therefore \cos^{-1} \frac{1-x^2}{1+x^2} + \tan^{-1} \frac{2x}{1-x^2}, = \cos^{-1} \cos 2\theta + \tan^{-1} \tan 2\theta = \frac{4\pi}{3}.$$

$$\therefore 2\theta + 2\theta, = 4\theta, = \frac{4\pi}{3}, \therefore \theta = \frac{\pi}{3}, = 60^\circ.$$

$$\therefore x = \tan \theta, = \tan \frac{\pi}{3}, = \tan 60^\circ, = \sqrt{3}.$$

$$\therefore x = \sqrt{3}.$$

II. Solution by JOHN B. FAUGHT, A. B., Indiana University, Bloomington, Indiana; J. A. JOHNSON, Jr., Student of the Sophomore Class, University of Mississippi; P. S. BERG, Apple Creek, Ohio; and J. W. WATSON, Middle Creek, Ohio.

$$\text{Since } \tan^{-1} \frac{2x}{1-x^2} = \cos^{-1} \frac{1}{\sqrt{1 + \frac{4x^2}{(1-x^2)^2}}} = \cos^{-1} \frac{1-x^2}{1+x^2};$$

$$\therefore 2 \cos^{-1} \frac{1-x^2}{1+x^2} = \frac{4}{3}\pi, \text{ or } \cos^{-1} \frac{1-x^2}{1+x^2} = \frac{2}{3}\pi = \cos^{-1}(-\tfrac{1}{2}).$$

$$\therefore \frac{1-x^2}{1+x^2} = -\tfrac{1}{2}, \text{ whence } x^2 = 3, \text{ and } x = \pm \sqrt{3}.$$

Also solved by F. P. MATZ, J. SCHEFFER, C. D. SCHMITT, E. L. SHERWOOD, M. C. STEVENS, G. B. M. ZERB; and \_\_\_\_\_